

CLAIMS

1. Plant for liquefying natural gas comprising:
 - (i) one pre-cooling heat exchanger having an inlet for natural gas and an outlet for cooled natural gas;
 - (ii) one main heat exchanger comprising a first hot side having one inlet connected to the outlet of the heat exchanger and an outlet for liquefied natural gas;
 - (iii) one main refrigerant circuit for removing heat from natural gas flowing through the first hot side of the main heat exchanger;
 - (iv) a pre-cooling refrigerant circuit for removing heat from the natural gas in the pre-cooling heat exchanger;and further comprising
 - (v) one additional circuit for removing heat from the main refrigerant in the main refrigerant circuit, where this circuit is separate from the pre-cooling refrigerant circuit;and wherein said main refrigerant circuit is separate from the pre-cooling refrigerant circuit.
2. Plant of claim 1, in which the additional circuit comprises a heat exchanger, a compressor, a cooler, and an expansion device, the compressor having an inlet and an outlet, said outlet being connected by means of a conduit to said cooler, said conduit extending via said expansion device to the inlet of the cold side of said heat exchanger, the outlet of the cold side of said heat exchanger being connected by means of return conduit to the inlet of said compressor.
3. Plant for liquefying natural gas comprising:

(i) one pre-cooling heat exchanger having an inlet for natural gas and an outlet for cooled natural gas;

5 (ii) a distributor having an inlet connected to the outlet for cooled natural gas and having at least two outlets;

10 (iii) at least two main heat exchangers each comprising a first hot side having one inlet connected to one outlet of the distributor and an outlet for liquefied natural gas;

15 (iv) at least two main refrigerant circuits for removing heat from natural gas flowing through the first hot side of the corresponding main heat exchanger;

20 (v) a pre-cooling refrigerant circuit for removing heat from the natural gas in the pre-cooling heat exchanger;

and further comprising

25 (vi) at least two additional circuits for removing heat from the main refrigerants in each of the main refrigerant circuits, where these circuits are separate from the pre-cooling refrigerant circuit;

and wherein said main refrigerant circuits are separate from the pre-cooling refrigerant circuit.

4. Plant of claim 3, in which the additional circuits each comprise a heat exchanger, a compressor, a cooler, and an expansion device, the compressor having an inlet and an outlet, said outlet being connected by means of a conduit to said cooler, said conduit extending via said expansion device to the inlet of the cold side of said heat exchanger, the outlet of the cold side of said heat exchanger being connected by means of return conduit to the inlet of said compressor.

5. Plant of claim 3, in which the additional circuits comprise each a heat exchanger and an expansion device, and further comprise one compressor and one cooler, the compressor having an inlet and an outlet, said outlet being connected by means of a conduit to said one cooler, said conduit being divided into conduits connected via said expansion device, to the inlet of the cold side of said heat exchanger, the outlet of the cold side of said heat exchanger being connected by means of return conduit to the inlet of said one compressor.

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15. Plant of claim 3, in which the additional circuits comprise an integrated heat exchanger and an expansion device, and further comprise one compressor and one cooler, the compressor having an inlet and an outlet, said outlet being connected by means of a conduit to said one cooler, said conduit being connected via said expansion device to the inlet of the cold side of said heat exchanger, the outlet of the cold side of said heat exchanger being connected by means of return conduit to the inlet of said one compressor.

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30. Plant of claim 3, comprising two main heat exchangers, two main refrigerant circuits and two additional circuits.

35. Plant of claim 1, in which the pre-cooling refrigerant circuit comprise a heat exchanger, a compressor, a cooler, and an expansion device, the compressor having an inlet and an outlet, said outlet being connected by means of a conduit to said cooler, said conduit extending via said expansion device to the inlet of the cold side of said heat exchanger, the outlet of the cold side

of said heat exchanger being connected by means of return conduit to the inlet of said compressor.

5 9. Plant of claim 3, in which the pre-cooling refrigerant circuit comprise a heat exchanger, a compressor, a cooler, and an expansion device, the compressor having an inlet and an outlet, said outlet being connected by means of a conduit to said cooler, said conduit extending via said expansion device to the inlet of the cold side of said heat exchanger, the outlet of the cold side of said heat exchanger being connected by means of return conduit to the inlet of said compressor.

10 10. Plant of claim 1, further comprising:
(vii) downstream said pre-cooling heat exchanger, a pretreatment for removing part of the heavy components from the gas.

15 11. Plant of claim 3, further comprising:
(vii) downstream said pre-cooling heat exchanger, a pretreatment for removing part of the heavy components from the gas.

20 12. Process for liquefying natural gas comprising:
(i) pre-cooling natural gas in a pre-cooling heat exchanger into a flow of pre-cooled natural gas;
30 (ii) liquefying said pre-cooled gas flow in one heat exchanger comprising a first hot side having one inlet connected to the outlet of the heat exchanger and an outlet for liquefied natural gas;
35 (iii) removing heat from the natural gas flowing through the first hot side of the main heat exchanger using a main refrigerant circuit;

(iv) removing heat from the natural gas in the pre-cooling heat exchanger using a pre-cooling refrigerant circuit;

and further comprising

5 (v) removing heat from the main refrigerant in the main refrigerant circuit, in one additional circuit where the step of removing heat from the main refrigerants is separate from the step of removing heat from the natural gas in step 10 (iv);

and wherein the step of removing heat from the natural gas in step (iv) does not make use of said main refrigerant circuit.

15 13. Process for liquefying natural gas comprising:

(i) pre-cooling natural gas in a pre-cooling heat exchanger into a flow of pre-cooled natural gas;

20 (ii) distributing said flow of pre-cooled natural gas into at least two distributed pre-cooled gas flows;

25 (iii) liquefying said at least two distributed pre-cooled gas flows in at least two main heat exchangers each comprising a first hot side having one inlet receiving one distributed pre-cooled gas flow and an outlet for liquefied natural gas;

30 (iv) removing heat from the natural gas flowing through the first hot side of the corresponding main heat exchanger using two main refrigerant circuits;

(v) removing heat from the natural gas in the pre-cooling heat exchanger using a pre-cooling refrigerant circuit;

35 and further comprising

(vi) removing heat from the main refrigerants in each of the main refrigerant circuits, in at least two additional circuits where the step of

removing heat from the main refrigerants is separate from the step of removing heat from the natural gas in step (v);
5 and wherein the step of removing heat from the natural gas in step (iv) does not make use of said main refrigerant circuits.

14. Process of claim 12, further comprising:
10 (vii) pretreating flow of pre-cooled natural gas for removing part of the heavy components from the gas.

15. Process of claim 13, further comprising:
16 (vii) pretreating flow of pre-cooled natural gas for removing part of the heavy components from the gas.

17. Process of claim 12 carried out in the plant of
20 claim 1.

18. Process of claim 13 carried out in the plant of
21 claim 3.